

12-2016

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DOI: <https://doi.org/10.1080/08832323.2016.1256264>

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Citation

SEOW, Poh Sun and WONG, Suay Peng. Using a mobile gaming app to enhance accounting education. (2016). *Journal of Education for Business*. 91, (8), 434-439. Research Collection School Of Accountancy.

Available at: https://ink.library.smu.edu.sg/soa_research/1541

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Using a mobile gaming app to enhance accounting education

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ABSTRACT

The authors describe the first mobile gaming app for learning accounting, Accounting Challenge (ACE). On September 30, 2016, ACE had been downloaded 23,230 times, spanning 90 countries, and had won three international teaching awards. The app was motivated by the aim to empower students to learn accounting in a fun way, outside of the classroom. ACE combines mobile learning and game-based learning to generate interest and motivation for the digital-native students and is freely available in iPhone/iPad and Android version. Based on a voluntary students' survey, the majority rated ACE favorably, indicating that they were satisfied with the app. ACE was presented at several international and local events and received positive feedback.

KEYWORDS

Accounting education; app; mobile gaming; mobile learning

Accounting Challenge (ACE) is the first mobile gaming app for learning accounting. The use of this app empowers students to learn accounting in a fun way, outside the classroom. As a mobile gaming app, ACE combines mobile learning and game-based learning to generate interest and motivation for the digital-native students. It makes learning fun and livelier and people learn the best when they are having fun.

Rapid advances in mobile technologies have led to mobile devices becoming ubiquitous. Mobile technologies are seen to play an increasingly important role in the learning process (Hung & Zhang, 2012; Hwang & Tsai, 2011; Lan & Sie, 2010; Liu, Han, & Li, 2010). Lan and Sie (2010) defined mobile learning as a type of learning model that allows learners to obtain learning materials anywhere and anytime using mobile communication, mobile devices, and the Internet. Mobile learning has shown educational benefits such as improving student engagement and learning outcomes (Ahmed & Parsons, 2013; Kiger, Herro, & Prunty, 2012; Kissinger, 2013).

Educators have turned to game-based learning, ranging from digital games to traditional board games (Connollym, Boyle, MacArthur, Hainey, & Boyle, 2012; Richardson, 2012; Tanner & Lindquist, 1998). Lippicott and Pergola (2009) called game-based learning "edutainment," as games capitalize on the entertainment value of the activity to support academic learning. Game-based learning has enhanced learning in areas such as accounting (Murphy, 2005; Nitkin, 2011), financial education (Chambers & Shufflebottom, 2010a, 2010b), language

(Milutinovic, Barac, Despotovic-Zrakic, Markovic, & Radenkovic, 2011; Rosell-Aguilar & Qian, 2015), mathematics (Kiger et al., 2012; Kim et al., 2012), and science (Ahmed & Parsons, 2013; Sanchez & Olivares, 2011).

Connolly et al. (2012) found that playing computer games was linked to positive knowledge acquisition, perceptual and cognitive skills, behavioral change, affective and motivational outcomes, and physiological outcomes. Mobile gaming apps possess appealing designs which are attractive to learners and thus heighten their replay value, translating into better learning outcomes (Sanchez & Olivares, 2011). Chambers and Shufflebottom (2010a, 2010b) noted that mobile gaming apps impact the learning process as they are interactive and so takes the participant and changes them from bystander into an active participant of the learning experience. The interactivity increases learners' participation and motivation in the game, resulting in improved learning outcomes (Facer et al., 2004).

We organize the remainder of the article as follows. First, we present the objectives of the app. Then a description of the app follows. Next, we present the impact of the app. Last, we discuss the challenges faced during the development of the app.

Objectives of the app

Learning does not stop outside the classroom. Students often commented that they would want additional resources to help them strengthen their foundation in

accounting outside the classroom. This app aims to enhance learning of accounting outside the classroom by engaging students to play and learn accounting on the go, anywhere at any time. Mobile learning has the potential to enhance learning outside the classroom as almost every student nowadays has a smartphone. As mobile phones become ubiquitous, mobile learning is seen to play an increasingly important role in the learning process. Game-based learning has also gained popularity among educators in recent years. Educators have used a variety of games ranging from digital games to traditional board games to enhance learning.

As a mobile gaming app, ACE combines mobile learning and game-based learning to generate interest and motivation for the digital-native students. This app makes learning fun and livelier and people learn the best when they are having fun. After the launch of ACE, people were surprised that a mobile gaming app based on accounting could be created as accounting is perceived to be a dry and boring subject. Students are able to utilize their downtime, such as waiting time in between activities, to play and learn accounting. ACE provides immediate feedback, allowing students to learn from their mistakes in real time. ACE is interactive and students became active participants of the learning process.

Description of the app

ACE is freely available in iPhone/iPad and Android version. It is designed with a user-friendly interface. Selected screenshots of ACE are provided in the appendix. The student simply touches “start” to begin the game. The student may also choose to mute the music to focus on the game. At the start of the game, the student may choose either the financial accounting or management accounting module. The game is scalable to support other courses.

Students may choose to play the basic or all or practice mode category. For the financial accounting module, basic covers the foundational concepts of transaction analysis and double entry accounting system. The all category comprises questions under basic as well as advanced topics such as accounting for cash, inventories, short-term investments and receivables, property, plant and equipment, intangibles, liabilities, shareholders’ equity, bonds, statement of cash flows, and financial statement analysis. For the management accounting module, Basic includes questions testing fundamental cost concepts and classifications for product costing and the preparation of financial statements. All consists of questions on cost behavior, cost prediction, and cost-volume-profit relationships in addition to the basic questions. There is also a practice mode option with no time

restriction as students have indicated that they wish to play and learn without time pressure.

For each game session, the student has 100 s to answer a series of multiple-choice questions (MCQs) which will be randomly pulled from the back-end content management system based on the topic. There are currently around 1,500 questions in the content management system. Questions can be added easily by directly entering into the content management system or by entering the questions into an Excel spreadsheet and then uploading into the content management system.

The main game consists of MCQs. The questions are deliberately designed so that any calculation may be done mentally without the need of calculators. After each question, the student will know immediately whether the answer is correct or wrong. Students gain more time if they get the answers right within the first 5 s. Students will get two points for getting the correct answer and will be deducted one point for the wrong answer. The score and remaining time are displayed prominently to add to the excitement of the game.

There is a bonus round after every five MCQs. No point is given for the bonus rounds but more time will be awarded if the student answers the bonus questions correctly. There are two types of bonus questions. The first type of bonus questions consists of three items that pop out in quick succession. Each item relates to an account. The student has to tap the correct accounting element option (asset, liability, equity, income and expense) to correctly classify the item when it appears. The second type of bonus questions requires the student to drag and drop the correct debit and credit entry to record the given transaction.

At the end of the game, students may choose to review their responses to learn from their mistakes or retry. Correct answers are provided to enable students to learn from their mistakes. If review is chosen, the student may scroll through the screens to review all the questions that were answered during the game. The answers are highlighted in red if they are wrong and green if they are correct. Where the student has answered wrongly, the correct answers are provided to enable the student to learn from the mistakes. Students may compete with one another by posting their scores to the leader boards. Students have given feedback that they like this feature as it encourages them to improve and challenge their friends.

Impact of the app

On September 30, 2016, ACE had been downloaded 23,230 times, spanning 90 countries. The top three countries for the number of download were the United States, the Philippines, and Singapore. ACE has won three

international teaching awards. ACE was awarded the 2015 American Accounting Association Innovation in Accounting Education Award. The annual Innovation in Accounting Education Award¹ is intended to encourage innovation and improvement in accounting education, and submissions are judged by their innovation, demonstrated educational benefits, and adaptability by other academic institutions or to other situations. Professor Guido Geerts, Chair of the Award Committee, commented that “The Accounting Challenge is an exciting innovation that meets the needs of a fast changing learning environment.” This is the first time in the history of the AAA that the award had been presented to professors of a university outside of the United States.

ACE was also awarded the 2014 Bea Sanders/American Institute of CPAs (AICPA) Teaching Innovation Award (Honorable Mention). The Bea Sanders/AICPA Innovation in Teaching Award² recognizes and disseminates successful teaching practices in the first sequence of accounting. The third award was the 2013 CEEMAN Champion Award for innovative pedagogy. The CEEMAN Champion Award³ recognizes original innovative teaching process or methodology.

ACE was presented at several local and international events. Many participants gave positive feedback and indicated that they will share ACE at their universities. The Singapore Accountancy Commission (SAC) organized the inaugural 2016 Singapore Accountancy Education Symposium “The Future of Accountancy Education” and selected ACE for presentation. Mr Uantchern Loh, Founding Chief Executive of SAC, commented that “ACE has successfully integrated all the elements that appeal to millennials in learning an age-old subject. In bringing together concepts of accounting, gaming, apps and the Internet into a fun package, ACE has done an excellent job in taking accountancy education into the future.”

The Institute of Singapore Chartered Accountants (ISCA) has been sponsoring the Accounting Challenge Competition since 2013, in which students pitted their wits against each other using ACE. ISCA also featured ACE on its platforms, profiling ACE to members of the Singapore accounting profession. ACE also attracted the attention of the Singapore local newspapers, which reported how the app was used innovatively to learn accounting in a fun way.

Based on the 242 voluntary students’ survey responses, the majority rated ACE favorably, indicating that they were satisfied with the app. The survey includes six questions and the summary descriptive statistics are provided in Table 1.

Students also provided qualitative feedback. They commented about how ACE enabled an engaging and

Table 1. Student survey feedback on the ACE app.

| Question | <i>M</i> | <i>SD</i> |
|--|----------|-----------|
| 1. The design of ACE was appealing and highly motivating to use. | 5.85 | 0.95 |
| 2. ACE was engaging. | 6.05 | 0.86 |
| 3. ACE challenged me intellectually. | 6.05 | 0.84 |
| 4. ACE helped me learn accounting. | 5.76 | 1.02 |
| 5. I would recommend ACE to my peers. | 6.01 | 0.84 |
| 6. Overall, I am satisfied with ACE. | 6.00 | 0.84 |

Note. Survey scale ranges from 1 (*strongly disagree*) to 7 (*strongly agree*). ACE = Accounting Challenge.

fun way of learning. Selected student comments are provided in Table 2.

Instructors from other advanced accounting courses also encouraged their students to play ACE to revise their accounting knowledge.

Table 2. Selected student comments on the ACE app.

| What do you like about ACE? | What have you learned most from ACE? |
|--|--|
| “Fun and convenient way to revise financial accounting on the go” | “Revision of financial accounting topics I’ve overlooked over the years” |
| “Questions are relevant, challenging. Variety of question types” | “Tested my financial accounting foundation, identify key concepts that I was not sure about” |
| “Great graphics, exciting music, user-friendly” | “I have learnt from mistakes I have made during the game” |
| “Engaging game, makes me keep retrying” | “Topics that I am weak at. I was not very clear with certain concepts as I panicked under the time limit” |
| “Leader board encourages people to do well” | “To think and answer quickly under stress” |
| “Time limit challenges me to think quickly” | “Accounting journal treatment. (what to debit, what to credit)” |
| “Makes me feel like I’m making better use of my time on my way to school rather than staring out of the window” | “I realised that my financial accounting concepts are still not there yet!” |
| “It serves as a quiz to see if you have truly understood what you have learnt in class.” | “I think it really can be used a good yardstick to test how strong are my fundamentals, in addition I think it really it just forces me to recollect what I’ve learnt in the past” |
| “Interactive interface that keeps me engaged. Helps me retain the knowledge better as compared to textbook.” | “I learnt that learning accounting modules can be fun if we can constantly challenge ourselves and attain a sense of accomplishment.” |
| “The questions are not too simple and therefore present a very real challenge. I think it’s a very creative way to engage students using this app because most students spend their time playing games on their hand phones. This is a more productive way to play games!” | “Accounting knowledge is important as these questions asked are basic concepts that are important to have before we learn more advance accounting modules.” |
| “I like that ACE is very colorful and vibrant. This makes it very eye-catching and thus more engaging compared to other types of accountancy websites that are mainly just plain words.” | |

ACE = Accounting Challenge.

Challenges of app development

The first challenge relates to developing the concept of the game. The game could be presented in many forms ranging from an exciting story to a simple trivia. We considered the following factors (our target audience, the appeal of the game to the target audience, ease of maintenance, scalability and the time and costs to develop the app). We have to ensure that the content is relevant to the course. Students must be able to learn something that will help them improve their performance in the course. Thus, we designed questions that are relevant and provided feedback.

Next, we need to consider the mobile operating platform to run the app. We wanted the app to be played by as many users as possible and opted for both iOS and Android platform. During the development phase, there were upgrades by Apple and Google on both the iOS and Android platforms, which created technical compatibility issues. Another challenge relates to content creation. We could not use questions from textbooks to avoid copyright infringement. Thus, we need to create our own questions. To not repeat questions, we need to create sufficient number of questions for the test bank which took up a lot of time. The last challenge is to attract students to play the game. We shared the game in workshops, brown bags and other platforms with faculty and requested them to include the game as a learning tool in their courses. We also raised awareness by using the game in competitions for the students. We also shared the app in conferences and seminars both locally and internationally to raise the profile of the app.

Summary

In this article we describe the first mobile gaming app for learning accounting, ACE. As a mobile gaming app, ACE combines mobile learning and game-based learning to generate interest and motivation for the digital-native students. This app was motivated by the aim to empower students to learn accounting in a fun way, outside the classroom. ACE is freely available in iPhone/iPad and Android version. On September 30, 2016, ACE had downloaded 23,230 times, spanning 90 countries, and had won three international teaching awards. We hope that it will benefit more students. ACE was presented at several international and local events and received positive feedback. We believe that this innovative pedagogical approach to teaching accounting makes learning fun and students learn the best when they are having fun.

Notes

1. Information of the Innovation in Accounting Education Award is available online at <http://aaahq.org/About/Directories/2014-2015-AAA-Committees-Task-Forces/Award-Committees/Innovation-in-Accounting-Education-Award-Committee/Award-Criteria>

2. Information of the Bea Sanders/American Institute of CPAs Teaching Innovation Award is available online at <http://www.aicpa.org/interestareas/accountingeducation/resources/awards/pages/the%20bea%20sanders%20aicpa%20innovation%20in%20teaching%20award.aspx>
3. Information of the CEEMAN Champion Award is available online at <http://www.ceeman.org/competitions-awards/ceeman-champion-awards>

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Appendix

Below are selected screenshots for the Accounting Challenge app.

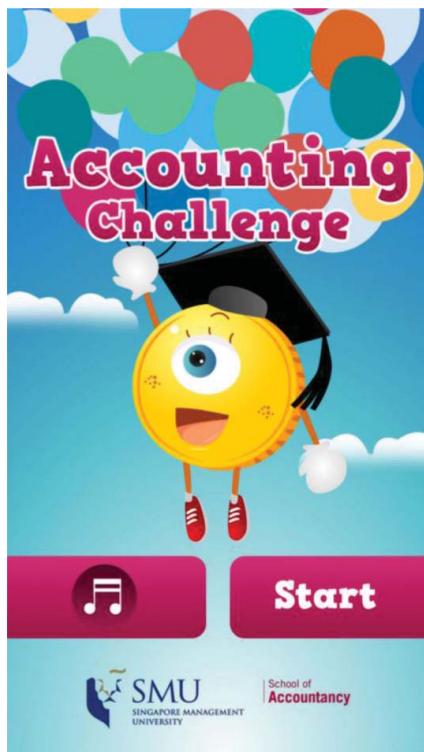


Figure A1. Home screen.

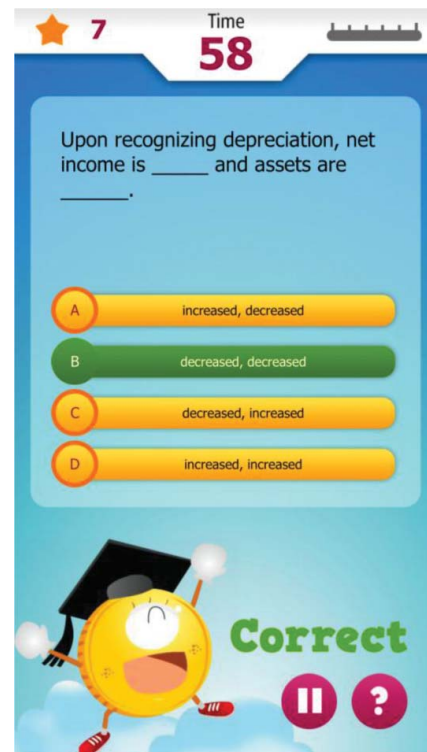


Figure A2. Students have 100 seconds to play the game by answering a series of multiple choice questions.

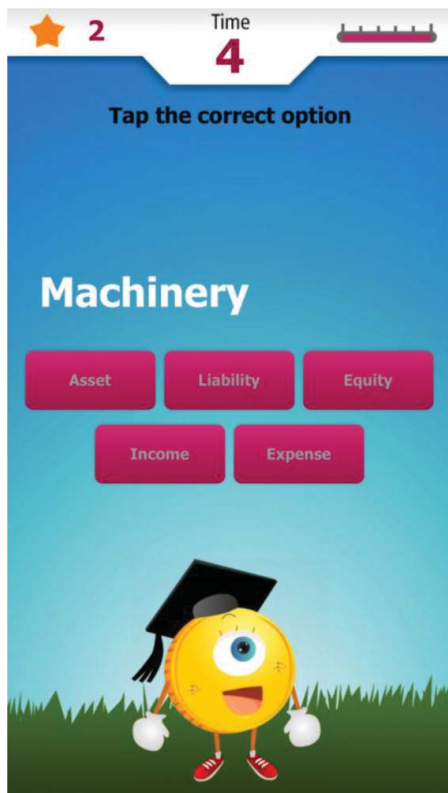


Figure A3. Bonus round 1: Students need to tap the correct accounting element.

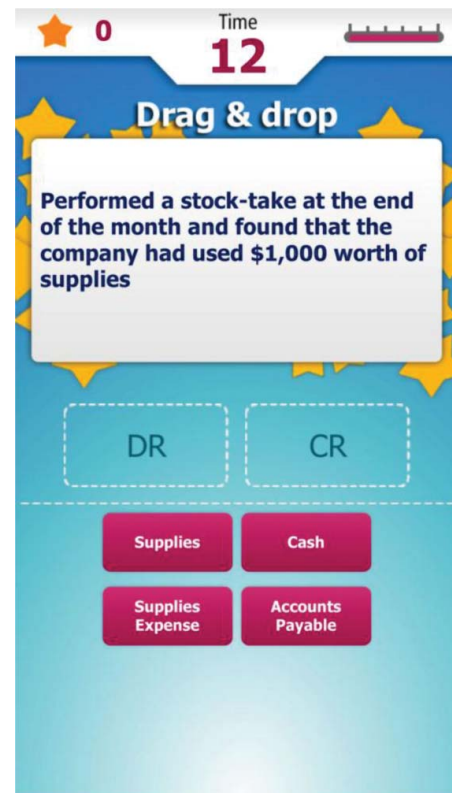


Figure A4. Bonus round 2: Students need to drag and drop the correct account for debit and credit.